UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/697,132	10/30/2003	Xianglin Wang	SAM2.0029	9973

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ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL.**   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,11-20 and 25-27* is/are rejected.

7)☒ Claim(s) *7-10 and 21-24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All   b)☐ Some * c)☐ None of:

         1.☐ Certified copies of the priority documents have been received.

         2.☐ Certified copies of the priority documents have been received in Application No. _____ .

         3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
     Paper No(s)/Mail Date *10/11/2005.*

4) ☐ Interview Summary (PTO-413)
     Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____ .

DETAILED ACTION

Specification

1.   The disclosure is objected to because of the following informalities:

- Page 12 line 9: "Transition Rage of Slant Image Edges" should be --
  Transition Range of Slant Image Edges --

- Page 22 line 22: "ASIC" should be -- Application-Specific Integrated
  Circuit (ASIC) --

Appropriate correction is required.

Claim Objections

2.   Claims 11 and 12 are objected to because of the following informalities:

- Claim 11 lines 9 and 10: "the difference signal" should be -- the
  difference of the signals --

- Claim 12 line 6: "the difference signal" should be -- the difference of the
  signals --

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3.   The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4.   Claims 14 and 27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

> Re claims 14 and 27: the claim limitation "determining a variance value for a plurality of pixels around a selected pixel inside said window;" in claim 14 lines 6-7, and "determines a variance value for a plurality of pixels around a selected pixel inside said window" in claim 27 lines 4-5, does not have a proper written description in the original disclosure as set forth by 35 U.S.C. 112 first paragraph. However, the method disclosed in the original disclosure recite the step of determining the "mean" value of the pixel window instead of determining the variance value. Therefore, the examiner suggests replacing the limitation "variance value" with -- mean value --.

> Appropriate correction is required.

5.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6.   Claims 3-10, and 17-26 are rejected under 35 U.S.C. 112, second paragraph, as

being indefinite for failing to particularly point out and distinctly claim the subject matter

which applicant regards as the invention.

- Claim 3 recites the limitation "the luminance transition range" in line 4.

    There is insufficient antecedent basis for this limitation in the claim.

- Claims 4-10 are dependent upon claim 3.

- Claim 17 recites the limitation "the luminance transition range" in line 3.

    There is insufficient antecedent basis for this limitation in the claim.

- Claim 18 is dependent upon claim 17.

- Claim 19 recites the limitation "the luminance transition range" in lines 3-4.

    There is insufficient antecedent basis for this limitation in the claim.

- Claim 20 is dependent upon claim 19.

- Claims 21-24 are dependant upon claim 17.

- Claim 25 recites the limitation "the original image signal f" in lines 2-3.

    There is insufficient antecedent basis for this limitation in the claim.

- Claim 26 is dependent upon claim 25.

        Appropriate correction is required.

Claim Rejections - 35 USC § 102

7.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8.   Claims 1-4, and 15-18 are rejected under 35 U.S.C. 102(e) as being anticipated

by Nagao (U.S. 6,628,842 B1).

Re claim 1: Nagao disclose a method of detail enhancement for an original

image signal represented by a set of pixels, comprising the steps of: (a) detecting

image pixels that belong to an image edge (FIG. 2 **16b** Col. 8 lines 58-61); (b)

generating gain suppression factors for the detected pixels ("blur retaining

coefficient" $C_{BS}(x,y)$, FIG. 2 **16d**, Col. 8 lines 58-61); and (c) performing image

detail enhancement on the image pixels while selectively reducing enhancement

of the detected image pixels relative to enhancement of other image pixels based

on the gain suppression factors (Equation 23, FIG. 2 **16i**, Col. 12 lines 59-67 and

Col. 13 lines 1-6).

Re claim 2: Nagao disclose selecting enhancement gain factors for the image

pixels (α, FIG. 3, Col. 19 lines 19-22); and combining the gain suppression

factors with the corresponding enhancement gain factors to obtain adjusted gain

factors (α* $C_{BS}(x,y)$); wherein the steps of performing image detail enhancement

further includes the steps of performing image detail enhancement on the image

pixels based on the adjusted gain factors to selectively reduce enhancement of the detected image pixels (Equation 30, FIG. 2 **16h**, Col. 15 lines 52-56).

Re claim 3, as understood: Nagao disclose detecting the center pixel location ("pixel of interest", Col. 9 lines 40-42) and the length of the luminance transition range of the edge (20, "expansion of the density's dynamic range", Col. 16 lines 23-31).

Re claim 4, as understood: Nagao disclose for each pixel within the detected luminance transition range, generating a gain suppression factor ($C_{BS}(x,y)$) based on: (i) the position of the pixel (x,y) within the luminance transition range, (ii) the enhancement gain factor (b_o) for that pixel, and (iii) the luminance contrast across the edge by using the normalized edge intensity data (E_V) (See Col. 12 lines 1-14).

Re claim 15: Nagao disclose a detail enhancement system for enhancing an original image signal represented by a set of pixels, comprising: (a) a detector that detects image pixels that belong to an image edge (**16b**, Col. 8 lines 58-61); (b) a generator that generates gain suppression factors for the detected pixels ("blur retaining coefficient" $C_{BS}(x,y)$, **16d**, Col. 8 lines 58-61); and (c) a detail enhancer that performs image detail enhancement on the image pixels while selectively reducing enhancement of the detected image pixels relative to

enhancement of other image pixels based on the gain suppression factors (See

FIG. 2 **16a, 16i**, Equation 23, Col. 12 lines 59-67 and Col. 13 lines 1-6).

Re claim 16: Nagao disclose the detail enhancer combines the gain suppression

factors with selected enhancement gain factor to obtain adjusted gain factors (α^*

$C_{BS}(x,y)$), and performs image detail enhancement on the image pixels based on

the adjusted gain factors to selectively reduce enhancement of the detected

image pixels (See FIG. 2 **16i**, Equation 30, Col. 15 lines 52-56).

Re claim 17, as understood: Nagao disclose the detector detects the center pixel

location (**16b**, Col. 9 lines 37-42) and the length of the luminance transition range

of the edge (20, "expansion of the density's dynamic range", Col. 16 lines 23-31).

Re claim 18, as understood: Nagao disclose the generator (**20**) generates a gain

suppression factor (($C_{BS}(x,y)$) for a pixel within the detected luminance transition

range based on: (i) the position of the pixel (x,y) within the luminance transition

range, (ii) the enhancement gain factor (b_o) for that pixel, and (iii) the luminance

contrast across the edge by using the normalized edge intensity data (E_V) (see

Col. 12 lines 1-14).

Claim Rejections - 35 USC § 103

9.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

10.   Claims 5, 6, 19 and 20 as understood are rejected under 35 U.S.C. 103(a) as

being unpatentable over Nagao in view of Nakazawa et al. (U.S. 5,471,987). The

teachings of Nagao have been discussed above.

However, Nagao fails to disclose the steps and selection of the gain suppression

factors such that detail enhancement at the center pixel location in the luminance

transition range is suppressed more than neighboring pixels in the luminance transition

range, wherein for pixel locations farther away from the center pixel location detail

enhancement suppression is further reduced and the gain suppression factors are

selected to essentially eliminate detail enhancement suppression for pixels outside the

detected luminance transition range.

Nakazawa et al. teaches the steps and selection of the gain suppression factors

("weighting") such that detail enhancement at the center pixel location ("central pixel") in

the luminance transition range is suppressed more than neighboring pixels in the

luminance transition range ("mask region"), wherein for pixel locations farther away from

the center pixel location detail enhancement suppression is further reduced (Col. 11

lines 43-52) as recited in claims 5 and 19, and the gain suppression factors are selected

to essentially eliminate detail enhancement suppression ("occurrence of an artifact can

be prevented") for pixels outside the detected luminance transition range (Col. 12 lines 12-21) <u>as recited in claims 6 and 20</u>.

Therefore, in view of Nakazawa et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nagao's system by incorporating the method steps of selecting the gain suppression factors such that detail enhancement at the center pixel location in the luminance transition range is suppressed more than neighboring pixels in the luminance transition range, wherein for pixel locations farther away from the center pixel location detail enhancement suppression is further reduced and the gain suppression factors are selected to essentially eliminate detail enhancement suppression for pixels outside the detected luminance transition range in order to inhibit the occurrence of artifacts in the border region of an image.

11.   Claims 11, 12, 25 as understood and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagao in view of Curry (EP 920,190 A2). The teachings of Nagao have been discussed above.

Nagao further teaches determining the steps of determining the difference between the original image signal $f(I_1(x,y))$ and the unsharp signal $f_1(I_S(x,y))$, wherein said difference represents image details; selectively boosting the difference signal such that enhancement of the difference signal at the detected pixel locations is reduced relative to enhancement of other image pixels based on the gain suppression factors $(\alpha\Delta I_{BS}(x,y))$; and adding the boosted signal to the original signal to obtain a detail

enhanced" image signal g ($I_2(x,y)$, Col. 19 lines 66-67 and Col. 20 lines 1-5) <u>as recited in claim 11</u>, and the enhanced image signal g is related to the original image signal f as: $g = (f - f_1)*K*\alpha + f$ wherein: $(f - f_1)$ is the difference signal ("edge enhanced component", Col. 7 lines 27-32), K is the enhancement gain factor for the pixel ("blur retaining coefficient" $C_{BS}(x,y)$, Col. 12 lines 49-55) and α is the gain suppression factor for the pixel (α, Col. 15 lines 53-56) <u>as recited in claims 12 and 26</u>.

Nagao further teaches the detail enhancer comprising: a difference node that determines the difference between the original image signal f and the unsharp signal f_1 ($I_S(x,y)$), wherein said difference represents image details; a combiner that selectively boosts the difference signal based on the gain suppression factors such that enhancement of the difference signal at the detected pixel locations is reduced relative to enhancement of other image pixels (**16f**, Col. 15 lines 53-56); and a summing node that combines the boosted signal to the original signal to obtain a detail enhanced image signal g (**16i**, Col. 15 lines 53-56) <u>as recited in claim 25</u>.

However, Nagao fails to disclose the step of and the filter that performs a low pass filter function on the image signal f to generate an unsharp image signal f_1.

Curry teaches the step of and the filter that performs a low pass filter function on the image signal f (I_{IN}) to $_{generate}$ an unsharp image signal f_1 (I_{MASK}, FIG. 1, Col. 2 lines 24-29) <u>as recited in claims 11 and 25</u>.

Therefore, in view of Curry, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nagao's system by including the method step of and filter that performs a low pass filter function on the image signal f to

generate an unsharp image signal f_1 in order to suppress the noise component of the

image.

12.   Claims 13, 14 and 27 as understood are rejected under 35 U.S.C. 103(a) as

being unpatentable over Nagao in view of Furusawa et al. (U.S. 5,050,227). The

teachings of Nagao have been discussed above.

        Nagao further teaches defining a two-dimensional window of pixels in the digital

image ("array of N_ExN_E pixels); defining a variance value for a plurality of pixels around

a selected pixel inside said window (Col. 40-56) as recited in claims 14 and 27.

        However, Nagao fails to disclose detecting image pixels that belong to a slant

image edge, based on the variance value, determining if the selected pixel is in an edge

region in the window; if the selected pixel is in an edge region, then determining if the

selected" pixel is essentially a center pixel in a luminance transition range of a slant

edge; and if the selected pixel is essentially a center pixel in a luminance transition

range of a slant edge, then determining the length of the luminance transition range of

the slant edge.

        Furusawa et al. teaches detecting image pixels that belong to a slant image edge

(FIG. 8, Col. 7 lines 1-3) as recited in claim 13, and determining if the selected pixel is in

an edge region in the window (Col. 5 lines 43-52); if the selected pixel is in an edge

region, then determining if the selected pixel is essentially a center pixel in a luminance

transition range of a slant edge (Col. 5 lines 43-52); and if the selected pixel is

essentially a center pixel in a luminance transition range of a slant edge, then

determining the length of the luminance transition range of the slant edge ("extending"

Col. 4 lines 64-66) as recited in claims 14 and 27.

Therefore, in view of Furusawa et al., it would have been obvious to one of

ordinary skill in the art at the time the invention was made to modify Nagao's system by

incorporating the method steps of detecting image pixels that belong to a slant image

edge and determining if the selected pixel is in an edge region in the window; if the

selected pixel is in an edge region, then determining if the selected pixel is essentially a

center pixel in a luminance transition range of a slant edge; and if the selected pixel is

essentially a center pixel in a luminance transition range of a slant edge, then

determining the length of the luminance transition range of the slant edge in order to

reproduce an image which appears sharp and natural.

Allowable Subject Matter

13.   Claims 7-10 and 21-24 would be allowable if rewritten to overcome the

rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to

include all of the limitations of the base claim and any intervening claims.

Conclusion

14.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure. La Rossa et al. disclose a Digital Image Processing Method for

Edge Shaping, Takamori disclose a Method of and Apparatus for Enhancing image

sharpness and Hardie disclose a Gradient-Based Edge Detection Using Nonlinear Edge

Enhancing Prefilters.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Jose M. Torres whose telephone number is 571-270-

1356. The examiner can normally be reached on Monday thru Friday: 8:00am -

4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Jong-Suk (James) Lee can be reached on 571-272-7044. The fax phone

number for the organization where this application or proceeding is assigned is 571-

273-8300.

Information regarding the status of an application may be obtained from the

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USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMT
11/16/2006

JONG SUK LEE
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